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EXAMINING THE IMPACT OF MILL CLOSURES ON THE TIMBER PRICES IN MONTANA AND THE IMPLICATIONS FOR NON-INDUSTRIAL LAND OWNERS

Examining the Impact of Mill Closures on the Timber Prices in Montana and the Implications for Non-industrial Forest Land Owners

Final Report

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Introduction

Mill closures in the wood using industries of the western United States have become a common occurrence in recent years and generate a variety of questions and concerns. Displaced workers, the loss of market shares to other domestic and foreign regions and producers, and the loss of marketing opportunities for forest and timberland managers are all frequently expressed topics. This study examines particular aspects of mill closures, how can forest managers expect mill closures to impact the markets for their timber? The initiation of this question came from Thornton Liechty, head of the Montana Private Forest Landowners Association. The purpose of this study is to quantify the impacts forest landowners in Montana can expect in terms of timber prices changes that mill resulting from mill closures in the state.

No two mill closures will have the same impact on standing timber prices in a region because mills have unique locations, and often occupy different niches in the timber market (e.g. stud mills, dimension mills, plywood plants and so forth). In addition some mills are much larger than others and some companies own two or more log processing facilities at different locations in the state or region. Thus a mill closure will change the comparative advantage of the remaining mills in terms of location to timber supplies. It will change the concentration of ownership of the remaining producers (how equally or unequally the ownership of capacity to produce wood products is distributed among owners). Closing a mill may or may not change the number of companies buying timber depending on whether or not the closure is one of several mills owned by the firm. Each of these factors has, at least in theory, an expected effect on the price of timber. Since

logs are heavy, the cost of transporting logs from woodlands to a mill is directly related to the distance traveled. Fewer processing facilities will typically increase the average distance for log hauling. If the ownership of processing facilities is highly concentrated, log buyers may be able to control the prices they offer for standing timber or delivered logs. Limited competition among buyers is referred to as monopsony (one buyer) or oligopsony (a few buyers). Concentrated ownership may reduce the price that forestland owners receive for their products. When a single company owns several mills in the same region, it will typically avoid self-competition in acquiring raw materials. Should a company such as this decide to shut down one of its mills, the number of potential processors does not change.

Background

The demand for timber coupled with the supply of timber together determines its value. Timber demand is derived from the demand for wood products. Indeed, timber (delivered logs) is a factor of production. The classic way of examining timber demand lies in production theory where the quantity of wood products produced is a function of capital, labor and unprocessed wood. Capital, or the means of production, is essentially the mills and equipment used to convert logs into wood products. Were it possible to estimate a wood products production function, the relationship between the quantity of capital and the demand for wood would be forthcoming. However, the usual assumptions utilized in empirical production functions are that there is uniformity in the price of the various factors, capital is uniform and measurable and that location is irrelevant.

Currently there is no data on capital as typically defined by economists at the state or sub state level. Prices for standing timber vary from place to place and differences between land ownerships are often extreme. For example Jackson, (1987) found that the state of Montana sold timber in the same market, as did the national forests but at averages prices more than twice those of the Forest Service. Furthermore, there is simply no comprehensive data available concerning timber (stumpage) prices sold from private land.

Studies of the role that industry structure plays in timber markets all point to the work by Mead (1966). He argued that the nature of the wood using industry in the Douglas-fir region was oligopsonistic. Because of the expense of hauling logs from the national forests where they were harvested, the number of potential mill buyers was typically limited to a few purchasers and hence bidding on national forest timber was limited. There are a variety of other factors which may affect the level of competition for timber aside from the structure of the wood processing industries. For example Jackson (1987) showed that the number of bidders varied in part due to the nature of the timber being offered for sale and that the National Forests in Montana typically had fewer bidders on their sales than did the State of Montana. However, the number of bidders has become a proxy for the degree of competition in the economic theory of auctions. See Friedman and Ostroy, (1995), and McAfee and Vincent (1992).

It is also important to note that harvested timber is not always milled in the county from which it is harvested. This is made clear from data summarized in Table 1. Three of 56

counties (Flathead, Lincoln and Missoula) accounted for 60% of the total wood processing in the state during 1998. The mills in each of the three major milling counties rely on wood coming from outside that county. For instance, 31.7% of the total wood processed in Flathead County came from that particular county and the rest was "imported" from other areas. See Figure 1 for Keegans's (2001) view of market areas. In the case of Flathead County 69% of the total wood processed came from the four-county Northwest Montana region. Lincoln County which is also a part of the Northwest region relied more heavily on wood produced within the Northwest region. Forty-four percent of the wood processed in Lincoln county mills came from within the county and 95.4% came from the Northwest region. Missoula County, which has been the second largest processing center in the state, seems to have a more spatially diverse supply of wood. Only 22.6% of the wood processed in Missoula County was produced within the county and less than a third came from the Southwest region of the state.

The "other sources"[1] listed at the end of Table 1 include other Montana Counties, out-of-state sources (primarily Idaho) and Canadian logs as well. It is worthy to note that Missoula mills had the highest share of its logs (31%) come from other sources.

Table 1 is important in other important respects. To the extent that timber harvesting is independent of the location of wood processing facilities, the loss of a mill in one county surely means that there will be changes in the origin and destination of logs harvested. To the extent that mills exist in a region due to the dependency on regional supplies of wood, reduction in timber harvesting in one county may have greater impacts on the

[1] The other source also includes a small amount of "unknown origin".

number of remaining mills and their capacity to produce wood products than would be the case in other counties and regions. Since the mills in Lincoln county were so apparently dependent on regional supplies, it would appear that timber shortages in that area would have comparatively greater implications on mill closures in that county than say in other areas.

Some Alternative Measures of Wood Processing Capital

While the federal government (Bureau of Economic Analysis) is attempting to develop measures of capital at the state or regional level of the entire economy, there is currently no specific regional or statewide measure of capital in the various wood using industries. As a result, we will present two alternative proxy measures of capital. Our focus is on the round wood using industries in Montana. That typically involves sawmills, plywood mills, pulp mills, log home manufacturers and post/pole manufacturing operations. In Montana, saw logs and veneer logs account for about 95% of the total products harvested (Keegan, et. al., 2001). By 1998 18 of the 73 sawmills accounted for 98% of the total production. The 11 largest lumber producers accounted for 89% of the total lumber production. Of course the 4 plywood plants accounted for all of the veneer logs production. While there are many mills, the closure of a small portable mill is of comparatively little consequence relative to the closure of one of the larger mills.

One approach to measuring capacity is to examine the rated capacity of a mill to produce lumber on an 8-hour shift basis. Some of this data is available from Random Lengths

annual Big Book. Some member companies voluntarily report the capacity of their mills to produce on an 8-shift capacity. Of course not all firms belong to the association and some members choose to report some of their mills and not others.

Another approach is to use a proxy measure, in this case, the value of the milling complex. In Montana, the Department of Revenue bases property taxes on the value of land and improvements inclusive of capital equipment.

Table 2 includes the data used for these two different proxy measures of capital. The Plum Creek mills in Flathead County are actually a complex of several mills at two different locations. Included in Flathead County are 2 Plum Creek sawmills, a medium density fiberboard plant, and two plywood plants. Plum Creek elects to disclose the rated capacities of the two plywood plants but not the capacities of their sawmills and fiberboard plant in Flathead County. In contrast, Plum Creek does disclose the capacity of their sawmill in Lake County. While the property tax data appears more complete, the data for R-Y lumber's two mills couldn't be located. It is possible that theses mills are owned by another legal entity. A geocode or owner name is necessary to find this data.

We started with a comprehensive list of sawmills in Montana. Many can't be located in the Department of Revenue property tax data. They may simply be portable mills that are not fixed as a permanent improvement to the land. We are confident that we have all of the major mills in the state. In order to use this proxy data, it was necessary to estimate the assessed value of the two R-Y mills. Using their rated capacity and the capacities and

assessed value of the other sawmills, an assessed value was estimated for the R-Y mills in the subsequent data analysis.

Selected Aspects of Location Theory, Timber Value and Approaches to Measurement

Location theory has its origins in Von Thunen's Theory of the Isolated State. He reasoned that patterns in the location of economic activity could be explained by differences in the costs of transporting different goods to the market. For an excellent discussion of location theory and transportation costs see Barlowe (1978). Large heavy goods, which are transported infrequently such as wood, would be produced in the hinterlands while goods, which are frequently transported such as eggs and butter, would be produced in areas closer to the marketplace. No doubt transportation costs are more complex than the simple distance traveled. But distance is a good indicator of transportation costs.

A variety of studies have documented location related aspects of timber value. Several years ago when the US Forest Service utilized a residual value method of timber appraisal, they used two sets of data; one for a west-side zone in Montana and one for an east-side appraisal zone. A typical component of the residual value method was the estimated haul cost, or the cost of hauling logs from the woodlands to a mill the appraiser judged would be the likely place of manufacturing. Jackson (2002) has developed regional zones for Montana timber prices, which form in part the basis for different

forestland tax rates in the state. McQuillan and True (1988) developed a method of explaining variation in timber prices based on the distance to regional milling clusters.

While it is readily recognized that there are regional differences in timber value, no study has explicitly examined how these timber prices differences are influenced by both proximity to capital and the structure or concentration of milling capacity.

A database of intercounty transportation distances was developed and used in this study. The distances used were those between county seats using a standard Montana highway map. Of course timber in a county is not found in the county seat. However, in all cases the county seat was the largest community in the county and either the milling center or close to the milling center located within the county. However these distances do help in explaining the patterns of mill consumption of logs as was shown in Table 1. (Figure 1 also shows the configuration of Montana counties and the general log supply regions.)

Developing Intercounty Measures of Proximity to Milling Capacity

Aside from how much timber is produced in a county, the data in Table 1 indicates that location is important in explaining the origin/destination of logs in Montana. As the distance between counties increases, the amount of timber delivered to the county decreases. From the standpoint of forestland managers, selling logs in an area with substantial milling capacity appears to be superior to selling logs in an area which is a great distance to processing capacity. As a result, we developed a measure of distance

weighted capacity for each county that supplies timber. This is the way it works. We utilized the 2003 taxable value of mills in each county. For example, the distance weighted capacity for 2003 Lincoln county was the capacity in Lincoln county plus the capacity in Flathead county divided by the distance from Lincoln to Flathead county plus the capacity in Sanders County divided by the distance from Lincoln to Sanders county and so forth for all other counties with milling capacity. More formally the distance weighted capacity for county *i* is:

$$DistWeightCap_i = \Sigma\ (Cap_i + Cap_j/Dist_{i\ to\ j})\ _{where\ j=1\ to\ n\ the\ number\ of\ counties} \quad (1)$$

Thus for example Lake County has two mills in our database and is also proximate to the mills in two adjacent counties, Flathead and Missoula counties. It has comparatively good access to capacity as compared to say Meagher County, which has no major mills and is not adjacent to any county with significant milling capacity.

Developing Intercounty Measures of Competitive Opportunities.

Related to the idea of the opportunities a landowner may have to market logs due to proximity to milling capacity is the idea of the number of potential mill purchasers of logs. For example if a landowner is in a county with substantial milling capacity but all

of the capacity is one firm, there may not be as much local competition for his/her timber were the same local capacity to be equally divided among 5 mill owners.[2]

A distance-weighted measure of the number of mill ownerships was developed for each county. An example will help explain how it works. Flathead County has several mills owned by Plum Creek Timber Company. Plum Creek was counted as one purchaser in Flathead County. In addition there were two other purchasers in that County. The weighted number of purchasers for Flathead County was the sum of three for the county itself plus the number in each other county divided by the distance from that county to Flathead County. Since Plum Creek also has a milling center in Lake County, that mill was not counted again in the Flathead distance weighted total. The assumption is that Plum Creek won't bid against itself in log procurement. There are two companies with mills in different counties; Plum Creek and R-Y Timber Company. In developing the distance-weighted number of major mills, the company that was closest to the county in question was counted and the more distant mill was not.

Explaining Differences in Timber Value Resulting from Distance to Capital and Market Structure—Some Empirical Evidence

Jackson and McQuillan (1979) demonstrated that timber prices could be predicted using regression techniques. They demonstrated that timber prices were a function of timber quality, market conditions and differences in logging systems. This early foray into

[2] Landowners may sell timber indirectly to mills. For example a logger may buy timber from a landowner and then sell logs to different mills. While this intermediate arrangement often occurs, the log markets are still limited by the number and location of mills purchasing logs.

transactions evidence appraisals focused on three ranger districts of the Lolo National Forest in Western Montana.

In testing the theories concerning proximity to capital and market structure, we have elected to focus on timber sold by the Montana Department of Natural Resources. The Montana DNRC has a trust mission that is quite similar to the idea of sustainable private forest management. National Forest management is currently characterized as "ecosystem management". While ecosystem management is rather amorphous, timber sales might be seen as being a byproduct of ecosystem management as opposed to projects where costs and revenues are important factors in selling timber. The impact of the ecosystem management philosophy on timber prices is unknown. The assessed value of individual mills is not readily available (one author happened to have the 2003 data as a result of an unrelated consulting project[3]). Thus, the competitive state timber sale population was limited to the calendar years of 2000 through 2002—a time period with a stable mill population.[4] The Montana DNRC sold 53 competitive timber sales in central and western Montana by sealed-bid auction during this time period.

In attempting to determine whether the measures of proximity to capital and industry structure are important determinants of timber prices, we have developed a regression model based on the use of ordinary least squares. The dependent variable is the winning adjusted bid (BIDPEAR). It is the sum of the winning bid, in dollars per thousand board

[3] The 2003 property tax assessments are based on 2002 real estate data.
[4] Stimson Timber Company announced the closure of their Libby (Lincoln County) milling operation at the end of 2002 and stopped processing in early 2003. Trout Creek Timber (Sanders County) closed in 2003 as did the Louisiana Pacific mill in Belgrade (Gallatin County).

feet and includes stumpage payments as well as payments for reforestation and slash disposal (forest improvement). The model includes variables, which are designed to predict the average selling price of timber based on variation in the value associated with different species included in the sale (REALSPLT) and variation in logging systems included in the sale. Two variables were included (PERHELI and PERVOLTR) which are the percentage of the sale volume yarded with helicopters and tractors respectively. In addition, the estimated cost of constructing forest roads and landings (RELDECST) was also included as an independent variable. These are the typical variables used in transaction evidence timber appraisal equations when the data comes from such a compact time period.[5]

To this set of variable we added our variables designed to measure market proximity and distance adjusted concentration of milling capacity. SCADTCAP is the variable defined in equation 1 but divided by one million. DWTBUY is the distance-adjusted number of different mill purchasers. In addition MULTINT is an interaction variable that is the product of DWTBUY and MULTINT. There is high simple correlation between the two variables so the interactive variable was added to avoid multicolinearity.

The statistical model is presented in Table 3. The calculated F indicates that the overall equation is significant. Total R-square is .465 and R-square adjusted for degrees of freedom is .382. Significance tests were conducted at the alpha level of .05. While the distance weighted capacity variable, by itself, was not significant, both DWTBUY and

[5] Were the data to be derived from a longer time period, other market indicator variables such as housing starts or timber sold and awaiting harvest might also be in the model.

MULTINT were. In addition, PERHEHI, RELDECST and REALSPLT also were significant independent variables. SCADTCAP, the measure of each county's access to milling capacity is significant at the alpha test level of .05 as is the interactive term (MULTINT). In contrast, DWTBUY, the variable designed to measure the competitive structure of the markets for each county where timber was sold is not significant. We cannot reject the null hypothesis that market structure has no impact on timber prices. Rather, we are able to conclude that access to capital and the interaction of access to capital and market structure significantly impact prices in Montana.

Using the Equation to Estimate how a Mill Closure will Affect Timber Prices

Three mills that are included in the database have closed. In addition, another mill has subsequently announced its intention to cease operations. The regression coefficients presented in Table 3 can be used to predict the impact of mill closures on timber prices. In order to do this, the DWTBUY, SCADTCAP and MULTINT variables must be recalculated for each county. Of course, price impacts will be greatest to landowners located nearest to the mills that close. Landowners in Lincoln, Sanders and Gallatin counties have no doubt experienced the greatest price impacts since these closures and the model predicts that the stumpage price decreases of $31.52/mbf, $38.94/mby and $45.60/mbf respectively in these counties. The average price decrease across all the counties included in the state timber sales program was estimated to be $6.20/mbf. That

means that the state itself would have received about $165,000 less for the timber it sold in 2002 and 2003 had the three mills closed before these sales were sold.[6]

Conclusions

By developing proxy measures of capital and more straightforward measures of industry structure, we have developed a method of examining the role these phenomena play in Montana timber pricing at the county level. By themselves these variables improve our ability to predict timber prices. In addition, the regression model can be used to estimate how changes in the variables affect timber prices. We conclude that mill closures will impact prices throughout the state. The greatest changes will be in counties where the mills are located but the impacts will spread around the state like the proverbial ripples in a pond. The measures of location were rather crude. No doubt, a GIS system could be employed to locate each sale and its proximity to every major mill in the area. That would allow a more refined way of valuation. The current method suggests that timber prices are uniform within a county and that is a useful simplification. However were more precise measures of location used, we would expect smoother gradients of value to be estimated.

The timber industry in the west is undergoing rather fundamental changes. These are induced in large part by shifts in log supplies from the federal lands. In turn as these federal supply shifts occur, the size, number and location of wood processing facilities

[6] All prices are expressed in 1996 dollars and the sales were calibrated using the Implicit GDP deflator.

change and new concentrations of ownership that result in turn affect rents associated with mill and timberland locations.

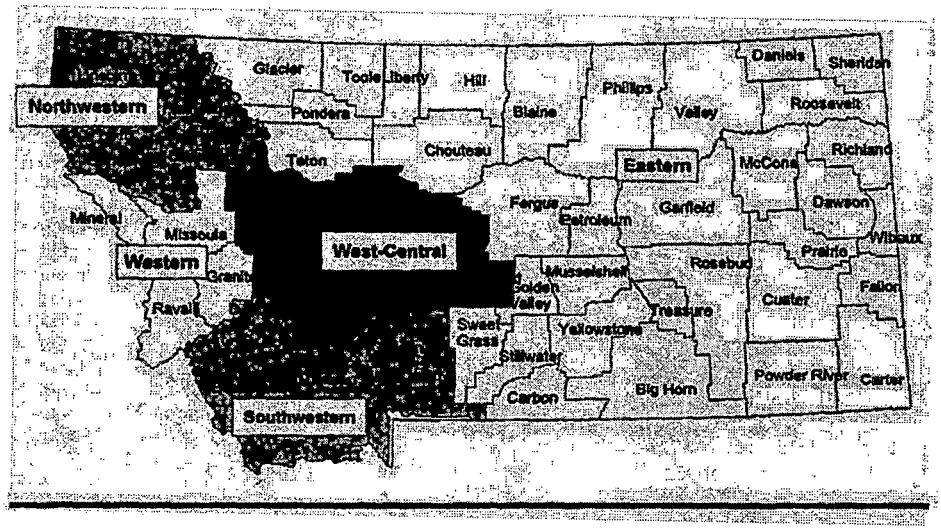

Figure 1
Montana Counties and Supply Regions

Table 1
County Origin of Timber Milled in Flathead and Lincoln Missoula Counties (1998)
(Thousand Board Feet Scribner)[7]

	Flathead	Lincoln	Missoula
County of Origin			
Flathead			
Volume	92,938	60,721	805
Distance *	0	89	115
% Col. Total	31.7%	44.7%	0.5%
Lake			
Volume	24,689	1,129	6,383
Distance	49	138	66
% Col Total	8.4%	0.8%	4.0%
Lincoln			
Volume	60,721	62,628	429
Distance	89	0	190
% Col. Total	20.7%	46.0%	0.3%
Sanders			
Volume	24,104	5,479	3,500
Distance	108	90	100
% Col. Total	8.2%	4.0%	2.2%
Northwest Montana			
% Col. Total	69.0%	95.4%	7.0%
Granite			
Volume	1,002	0	11,700
Distance	174	264	74
% Col. Total	0.3%	0.0%	7.4%
Missoula			
Volume	805	13,760	35,891
Distance	115	190	0
% Col. Total	0.3%	10.1%	22.6%
Mineral			
Volume	2,434	0	906
Distance	191	159	57
% Col. Total	0.8%	0.0%	0.6%
Ravalli			
Volume	1,548	0	3,150
Distance	165	240	50
% Col. Total	0.5%	0.0%	2.0%
Southwest Montana			
% Col. Total	1.9%	10.1%	32.6%
Lewis and Clark			

[7] Data from Keegan, et. al. 2001

Volume	701	0	12,355

Table 1 (continued)

Distance	196	285	115
% Co. Total	0.2%	0.0%	7.8%
Meagher			
Volume	0	0	8,551
Distance	270	359	189
% Col. Total	nil	0.02%	5.4%
Powell			
Volume	9,997	0	7,956
Distance	188	263	73
% Col. Total	3.4%	0.0%	5.0%
West Cent. Montana	10,698	0	35,234
% Col. Total	3.7%	0.0%	22.2%
All Remaining Sources			
Volume	25,028	18,644	49,070
% Col. Total	8.5%	13.7%	31.0%
Total	293,052	136,139	158,517

* Distance in miles between county seats.

Table 2
Proxy Measures of Capital

Name	County	Assesed Value'03	05 BigBk. mbf	05BigBk. msf	Plywood Scrib-mbf	$/mbf	estval	est value03	
Eagle Stud Mill, Inc	Granite	1,270,350	50			25407			1
F H Stoltze Land & Lumber Co	Flathead	5,931,054	160			37069.09			5
Finlay Lumber	Missoula	188208							
Hunt's Timbers, Inc.	Lake	612790							
Judith River Sawmill	Judith Bas.	85790							
Lousiana Pacific - Belgrade	Gallatin	2,009,790							2
Lousiana Pacific - Deer Lodge	Deer Lodge	3009726	180			16720.7			3
Owens & Hurst Lumber Co.	Lincoln	5938361	200			29691.81			5
Plum Creek - Columbia Falls Division	Flathead	36780776		200	60.6061				36
				212	64.2424				
Plum Creek - Pablo Sawmill	Lake	4083165	170		0	24018.62			4
Pyramid Mountain Lumber, Inc.	Missoula	8866029	184		0	48184.94			8
R-Y Timber Livingston	Park		100		0	0	4350527		4
R-Y Timber Townsend	Fergus		100		0	0	4350527		4
Stimson Lumber Co. - Bonner Plywood	Missoula	19171520		240	72.7273				1
Stimson Lumber Co. - Libby Plywood	Lincoln	3893385	40			97334.63			
Thompson River Lumber Co	Flathead	3379506	65			51992.4			
Tongue River Lumber Co.	Rosebud	979167							
Tricon Timber	Mineral	1404284	125			11234.27			
Vinson Timber Products	Sanders	9339924	100			93399.24			
Gebhardt			10			435052.7			
rbm					mean	43505.27			
silver city			100						
lone pine			150						
north end			50						
foothills st ignatius			15						

Table 3

Predicting Timber Prices with the Inclusion of Measures of Proximity to Milling Capital and Local Market Structure

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+-----------------------------------------------------+
| Ordinary    least squares regression                |
|                           | |                       |
| LHS=RELBPEAR Mean                 =   207.6040      |
|              Standard deviation   =   66.44959      |
| WTS=none     Number of observs.   =         53       |
| Model size   Parameters           =          8       |
|              Degrees of freedom   =         45       |
| Residuals    Sum of squares       =   122807.6      |
|              Standard error of e  =   52.24039      |
| Fit          R-squared            =   .4651434      |
|              Adjusted R-squared   =   .3819435      |
| Model test   F[  7,    45] (prob) =   5.59 (.0001)  |
| Autocorrel   Durbin-Watson Stat.  =  2.0230696      |
|              Rho = cor[e,e(-1)]   =  -.0115348      |
| White heteroscedasticity robust covariance matrix   |
| Br./Pagan LM Chi-sq [  7]  (prob) =   9.28 (.2330)  |
+-----------------------------------------------------+
```

Variable	Coefficient	Standard Error	t-ratio	P[|T|>t]	Mean of X
Constant	-68.5346779	52.4710603	-1.306	.1981	
DWTBUY	47.8720882	19.8348077	2.414	.0199	1.32730241
SCADTCAP	.47386399	1.71230256	.277	.7832	16.4967817
MULTINT	-1.25594697	.53168184	-2.362	.0226	41.0766884
PERHELI	-.83389724	.39966050	-2.087	.0426	3.26415094
PERVOLTR	.52223803	.35007203	1.492	.1427	75.0622642
RELDECST	-.89768984	.30014527	-2.991	.0045	21.8405676
REALSPLT	.78400166	.19649539	3.990	.0002	305.482194

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